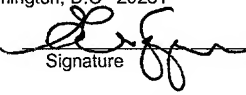


## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§	Serial No:	To Be Assigned
Richard E. Smalley et al.	§		(division of application
	§		Serial No. 09/380,545)
For: CARBON FIBERS FORMED FROM	§		
SINGLE-WALL CARBON	§	Filed: CONCURRENTLY HEREWITH	
NANOTUBES	§		
	§	Group Art Unit: 1754 (anticipated)	
	§		
Atty Dkt: 11321-P012USD2	§	Prior Examiner: Stuart Henderson	
	§	703.308.2539	

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**PRELIMINARY AMENDMENT ACCOMPANYING REQUEST FOR FILING  
DIVISIONAL APPLICATION UNDER 37 C.F.R. § 1.53(b)**

Sir:

This paper accompanies a Request for Filing Divisional Application Under 37 C.F.R. § 1.53(b) and associated filing fee therefor ("the Request"). If the fee payment is missing or insufficient in amount, or if any other fees are determined to be due, the Assistant Commissioner, Commissioner, and/or the Director of the U.S. Patent & Trademark Office is/are hereby authorized to charge any such fees (or credit any overpayment) to Winstead Sechrest & Minick Deposit Account No. 23-2426, referencing matter number 11321-P012USD2.

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37 C.F.R. § 1.53(b)

## AMENDMENTS

### In the Title

Please amend the title by replacing the present title with the following:

--METHOD FOR CUTTING NANOTUBES--

### In the Abstract

Please amend the abstract by replacing the present abstract with the following:

-- This invention relates generally to cutting single-wall carbon nanotubes (SWNT). In one embodiment, the present invention provides for preparation of homogeneous populations of short carbon nanotube molecules by cutting and annealing (reclosing) the nanotube pieces followed by fractionation. The cutting and annealing processes may be carried out on a purified nanotube bucky paper, on felts prior to purification of nanotubes or on any material that contains single-wall nanotubes. In one embodiment, oxidative etching with concentrated nitric acid is employed to cut SWNTs into shorter lengths. The annealed nanotubes may be disbursed in an aqueous detergent solution or an organic solvent for the fractionation. Closed tubes can also be derivatized to facilitate fractionation, for example, by adding solubilizing moieties to the end caps.--

### In the Specification

Please amend the specification as noted on page 5, paragraph 11 of the Request by inserting before the first line of the specification the following:

### --RELATED APPLICATIONS

This application is a division of co-pending prior U.S. patent application Serial No. 09/380,545, filed on September 3, 1999, entitled "CARBON FIBERS FORMED FROM SINGLE-WALL CARBON NANOTUBES," which is the 35 U.S.C. § 371 national application of International Application Number PCT/US98/04513 filed on March 6, 1998, which

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designated the United States, claiming priority to: provisional U.S. patent application Serial Number 60/067,325, filed on December 5, 1997; provisional U.S. patent application Serial Number 60/064,531, filed on November 5, 1997; provisional U.S. patent application Serial Number 60/063,675, filed on October 29, 1997; provisional U.S. patent application Serial Number 60/055,037, filed on August 8, 1997; provisional U.S. patent application Serial Number 60/047,854, filed on May 29, 1997; and provisional U.S. patent application Serial Number 60/040,152, filed on March 7, 1997. Each of the foregoing applications is commonly assigned to the assignee of the present invention and is hereby incorporated herein by reference in its entirety.

This application discloses subject matter related to the subject matter of U.S. patent application Serial Number 10/000,746, filed on November 30, 2001 in the name of Daniel T. Colbert et al., entitled "MACROSCOPICALLY MANIPULABLE NANOSCALE DEVICES MADE FROM NANOTUBE ASSEMBLIES," which application is commonly assigned to the assignee of the present invention.--

### In the Claims

Please amend the claims as follows:

A. Please cancel claims 1-17 and 31-162 without prejudice or disclaimer to the subject matter thereof.

B. Please amend claim 18 as follows:

18. (Amended) A method for producing tubular carbon molecules of about 5 to 500 nm in length, said method comprising the steps of:

- (a) providing a single-wall carbon nanotube-containing material;
- (b) cutting single-wall nanotube containing-material to form a mixture of tubular carbon molecules having lengths in the range of about 5 to 500 nm;
- (c) isolating from said mixture of tubular carbon molecules a fraction of said molecules having substantially equal lengths.

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C. Please amend claim 19 as follows:

19. (Amended) The method of claim 18 wherein said cutting single-wall nanotubes into tubular carbon molecules comprising the steps of:

(a) forming a substantially two-dimensional target containing single-wall nanotubes of lengths up to about one micron or more; and

(b) irradiating said target with a high-energy beam of high mass ions.

D. Please amend claim 23 as follows:

23. (Amended) The method of claim of 22 wherein the high mass ion is Au<sup>+33</sup>.

E. Please amend claim 30 as follows:

30. (Amended) The method of claim 28 wherein said substituent is selected from the group consisting of hydrogen; alkyl; acyl; aryl; aralkyl; halogen; substituted thiol; unsubstituted thiol; substituted amino; unsubstituted amino; hydroxy; and OR', wherein R' is selected from the group consisting of alkyl, acyl, aryl, aralkyl, substituted thiol, unsubstituted thiol, substituted amino, unsubstituted amino, a linear carbon chain, and a cyclic carbon chain.

F. Please add the following new claims 163-175:

163. (New) The method of claim 30 wherein the linear carbon chain, the cyclic carbon chain, or both, are interrupted by at least one heteroatoms.

164. (New) The method of claim 30 wherein the linear carbon chain, the cyclic carbon chain, or both, are substituted with a moiety selected from the group consisting of at least one =O, =S, hydroxy, aminoalkyl, amino and a peptide of 2-8 amino acids.

165. (New) The method of claim 29 wherein the substituent is selected from the group consisting of alkyl; acyl; aryl; aralkyl; halogen; substituted thiol; unsubstituted thiol; substituted amino; unsubstituted amino; hydroxy; and OR', wherein R' is selected from the group consisting

of alkyl, acyl, aryl, aralkyl, halogen, substituted thiol, unsubstituted thiol, substituted amino, unsubstituted amino, a linear carbon chain and a cyclic carbon chain.

166. (New) The method of claim 165 wherein the linear carbon chain, the cyclic carbon chain, or both, are interrupted by at least one heteroatoms.

167. (New) The method of claim 165 wherein the linear carbon chain, the cyclic carbon chain, or both, are substituted with a moiety selected from the group consisting of at least one =O, =S, hydroxy, aminoalkyl, amino and a peptide of 2-8 amino acids.

168. (New) A method for producing substantially un-tangled single-wall carbon nanotubes comprising:

- (a) providing tangled single-wall carbon nanotubes;
- (b) forming a suspension of the tangled single-wall carbon nanotubes in a liquid medium, wherein the liquid medium comprises a solution selected from the group consisting of an aqueous solution, a solution comprising sodium dodecyl sulfate, a solution comprising non-ionic surfactant and combinations thereof;
- (c) cutting at least a portion of the single-wall carbon nanotubes to untangle at least some of the single-wall carbon nanotubes; and
- (d) recovering material comprising single-wall carbon nanotubes untangled by the cutting step.

169. (New) The method of claim 168 wherein the tangled single-wall carbon nanotubes comprise ropes of single-wall carbon nanotubes.

170. (New) The method of claim 169 wherein the cutting step comprises sonication and wherein at least one of the ropes is cut.

171. (New) The method of claim 168 further comprising fractionating the single-wall carbon nanotubes into at least one fraction of the single-wall carbon nanotubes having a homogeneous

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characteristic selected from the group consisting of lengths, diameters, helicities and combinations thereof.

172. (New) The method of claim 171 wherein the fractionating step comprises a method selected from the group consisting of field-flow fractionation, light scattering methods and combinations thereof.

173. (New) The method of claim 168 wherein the suspension is a stable colloidal suspension.

174. (New) A method comprising:

- (a) applying an electric field to a suspension of single-wall carbon nanotubes; and
- (b) removing the single-wall carbon nanotubes from the suspension.

175. (New) A method of forming a film comprising:

- (a) providing a suspension of single-wall carbon nanotubes; and
- (b) electrodepositing the single-wall carbon nanotubes on a surface to form a film of single-wall carbon nanotubes.

### REMARKS

A. *Status of the Application.* On September 3, 1999, Applicant filed the parent patent application, U.S. patent application Serial No. 09/380,545, which included originally filed claims 1-162. In an Office Action, dated June 20, 2000, ("the Office Action") the Examiner subjected the claims to a restriction requirement. According to the Office Action, the parent patent application's claims were directed to eleven (11) distinct inventions. Applicant elected the invention of Group VIII in the parent patent application. The present divisional application is directed to the invention of Group II, which were identified as the invention claimed by originally filed claims 18-30.

Accordingly, originally filed claims 18-30 remain in the application, and the other originally filed claims -- claims 1-17 and 31-162 -- are cancelled herein without prejudice or disclaimer to the subject matter thereof. Additionally, claims 163-175 have also been added herein. No new matter is added by the addition of these claims.

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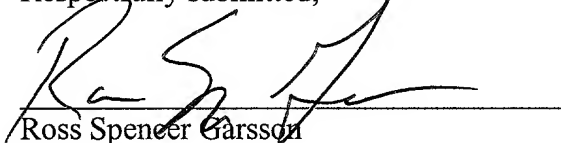
B. *Amended Claims.* Claims 18, 19, 23, and 30 are amended herein. The Applicant respectfully asserts that the amendment to claims 18, 19, 23, and 30, and incorporated by reference in any claims depending therefrom, are not narrowing amendments made for a reason related to the statutory requirements for a patent that will give rise to prosecution history estoppel. *See Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 234 F.3d 555, 566, 56 U.S.P.Q.2d 1865, 1870 (Fed. Cir. 2001).

Attached hereto is a marked-up version of the changes made to claims 18, 19, 23, and 30 by the current amendment. The attached page is captioned **"Version with Markings to Show Changes Made."**

### CONCLUSION

It is believed that each of the claims now pending in the present application recites elements neither taught nor suggested by the prior art. Further, it is believed that the application as a whole is in proper form and condition for allowance. If the Examiner believes that the application may be placed in even better condition for allowance, he or she is invited to contact the undersigned at the telephone number noted below. Alternatively, or in addition, if the Examiner believes that an Examiner interview would be beneficial, the Examiner is invited to note that the undersigned has ready access to the videoconferencing facilities of the South Central Intellectual Property Partnership at Rice University in Houston, Texas. The inventors and the undersigned would welcome the opportunity to use those facilities to clarify any issues deemed to remain unresolved.

Respectfully submitted,



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Date: December 28, 2001

ATTORNEYS FOR ASSIGNEE

**Version with Markings to Show Changes Made**

18. (Amended) A method for producing tubular carbon molecules of about 5 to 500 nm in length, said method comprising the steps of:

- (a) providing a single-wall carbon nanotube-containing material;
- (b) cutting single-wall nanotube containing-material to form a mixture of tubular carbon molecules having lengths in the range of [5-500] about 5 to 500 nm;
- (c) isolating from said mixture of tubular carbon molecules a fraction of said molecules having substantially equal lengths.

19. (Amended) The method of claim 18 wherein said cutting single-wall nanotubes into tubular carbon molecules comprising the steps of:

- (a) forming a substantially two-dimensional target containing single-wall nanotubes of lengths up to about one micron or more[,]; and
- (b) irradiating said target with a high-energy beam of high mass ions.

23. (Amended) The method of claim of 22 wherein the high mass ion is  $[Au^{-33}]$   $Au^{+33}$ .

30. (Amended) The method of claim 28 [or 29] wherein said substituent is selected from the group consisting of [each may be independently selected from the group consisting of] hydrogen; alkyl<sub>1</sub>[,]; acyl<sub>1</sub>[,]; aryl<sub>1</sub>[,]; aralkyl<sub>1</sub>[,]; halogen; substituted thiol; [or] unsubstituted thiol<sub>1</sub>[,]; substituted amino; unsubstituted [or substituted] amino; hydroxy<sub>1</sub>[,]; and OR'<sub>1</sub> wherein R' is selected from the group consisting of [hydrogen,] alkyl, acyl, aryl<sub>1</sub>, aralkyl, [unsubstituted or substituted amino,] substituted thiol, [or] unsubstituted thiol[,]; substituted amino, unsubstituted [or substituted] amino<sub>1</sub>[,]; hydroxy; and OR' wherein R' is selected from the group consisting of hydrogen, alkyl, acyl, aralkyl, unsubstituted or substituted amino; substituted or unsubstituted thiol; and halogen; and] a linear carbon chain, and a [or] cyclic carbon chain [optionally interrupted with one or more heteroatom, and optionally substituted with one or more =O, or =S, hydroxy, an aminoalkyl group, an amino acid, or a peptide of 2-8 amino acids].